



CQ-TV

no 59

*The Journal of
the British Amateur
Television Club*

THE BRITISH AMATEUR TELEVISION CLUB

B.A.T.C. COMMITTEE MEMBERS



GENERAL INFORMATION

Introduction.

The club was founded in 1949 to inform, instruct and co-ordinate the activities of amateur radio enthusiasts experimenting with television transmission, and to liaise with other enthusiasts engaged on similar work overseas. The club is affiliated to the Radio Society of Great Britain, and has a membership of over 800 at the present time. Of these, about one third reside abroad; in particular, there is much amateur activity in Australia, Canada, France, the Netherlands, and the U.S.A.

Experiments carried out by BATC members have been mainly in two directions: R.F. and video. As few members have the resources to build both sorts of equipment, many have combined to form constructional groups, to hold lectures, and to take part in local exhibitions. There are local groups of this type in various places. The Hon. Secretary will be pleased to let you know the names and addresses of members in your district.

Club Standards.

On the video side, the standards recommended are such that a normal domestic TV set can be used as a monitor, with waveforms similar to BBC-TTA. For interchangeability, members are recommended to arrange all video outputs at the one volt level, whites positive syncs negative; pulses at the two volt level negative going with all signals at 75 ohm impedance. Belling-Lee plugs and sockets are preferred.

Slow-Scan Picture Transmission.

Another branch of the hobby has become popular: slow-scan television. The line and frame rates (25 c/s and one frame in 5 seconds) are sufficiently slow to permit pictures to be tape-recorded or transmitted, using band widths of the order of three or four kc/s only.

Transmitting Licence.

On the radio side, the experimenter must hold a GPO amateur vision licence, costing £2 per annum, but not requiring a knowledge of morse. Operation is permitted in the 70 cm band and on shorter wavelengths. Full details can be obtained from the GPO Radio Branch, St. Martins le Grand, London, E.C.1.

Camera Tubes.

Vidicon camera tubes, rejected by the manufacturers for minor blemishes are available to Club members for a nominal price and can be sent to any part of the world. Reject monoscopes are available in the U.K. only for £7.10s. Information on the procedure for ordering a tube, and for ordering vidicon scan and focus coils can be obtained from the Hon. Secretary.

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Transistor RF amplifiers and Frequency Multipliers

Since the advent of transistors capable of working well into the UHF region at 'reasonable' prices several people have built all transistor 70 cm. converters. This article is intended to pass on some of the points found useful whilst being professionally engaged on the fruitless pursuit of watts at 4 Kmc/s. in a match box.

The transistor may be used in three configurations but at RF only the grounded base and common emitter modes are useful. At low power levels the grounded base seems the most docile whilst at high power the common emitter seems to be preferable. The basic grounded base circuit is shown in Fig. 1: this is using a positive earth rail which is probably the best arrangement, C2 and C3 being feed through capacitors. If a frequency multiplier is required then Fig. 1 comes miraculously into use - L2, C4 being tuned to the required output frequency.

All the best books used to say that whilst transistor doublers were satisfactory, triplers were definitely forbidden. This is not so. However, I would not recommend greater than x4 multiplication per stage on efficiency grounds. Transistors can be used as multipliers up to their f_t with good results. The mode of operation is a little odd in that transistors with a relatively high base-emitter capacity are most useful as one can produce varactor action across this junction making for more efficient multiplication. The new 'overlay' transistors are particularly suitable to this mode of operation. Outputs of 2-10 mw. can be obtained from small transistors doubling to 450 mc/s. (BSY27 f_t 425 mc/s.)

This varactor action is no use at all when dealing with straight RF amplifiers, it being merely a hindrance. However, transistors like the 2N918 (f_t 800 Pt 200 mw.) can produce 100 mw of RF up to, say, 500 mc/s. If a lot more power

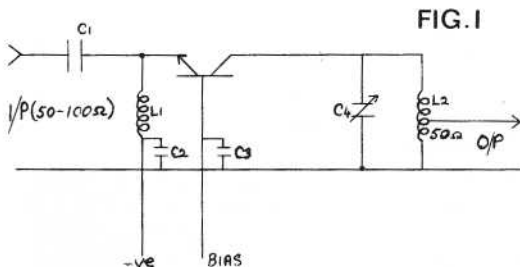


FIG. 1

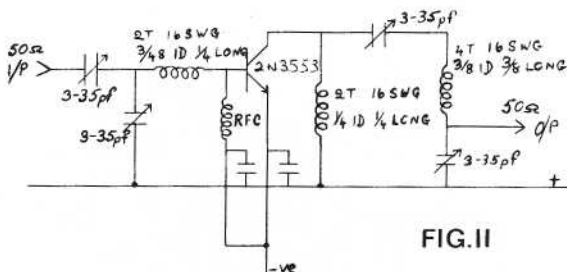


FIG. II

L AND C VALUES FOR 144 MC/S

is required my first answer is give up! However, knowing how difficult it is to deter the average amateur the following paragraph is included - but don't expect to be successful!

At VHF high power levels the common emitter mode seems more stable than grounded base. Transistors are available for about £2 giving quoted outputs of 10 watts at 400 mc/s. with a gain of 3Db. and more gain and power at lower frequencies. If these transistors are used as amplifiers and multipliers good results can be obtained especially with the new overlay type used as amplifying varactor multipliers. Fig. 2 shows a basic common emitter circuit which, using an RCA 2N3553, gives $\frac{1}{2}$ w. out from 20 mw. drive and 3W. out from $\frac{1}{2}$ W drive at 144 mc/s. The utmost care must be taken as there is no telling what frequencies may be generated by the device. The only real hope is to use a wide band spectrum analyser (Hewlett-Packard £3750 or the economy model Polorad £2750): you could try a band pass filter in the output if you don't have an analyser but remember that filters are transparent at harmonics so you also require a low pass one as well. It is most important to terminate such amplifiers properly at all times, even before you switch on otherwise the transistor will oscillate and zip goes £5.

This amplifier has exhibited the ridiculously high DC-RF efficiency of 80%. This sounds most unlikely but exhaustive tests only confirm this figure, thus these devices can be most useful.

A word about VHF crystal oscillators seems in place as they can be most useful. Overtone crystals for 100 mc/s can be obtained from STC for about 30/-. The writer's 70 cm. converter uses a 75 mc/s. crystal tripled then doubled, thus the local oscillator chain consists of only three transistors. The colpitts seems to be the best circuit for use with VHF overtone crystals and one is shown in Fig. 3. L1 resonates with C1 and C2 and this can be set up with a GDO. C1 varies the feedback and is best set to about halfway to start with.

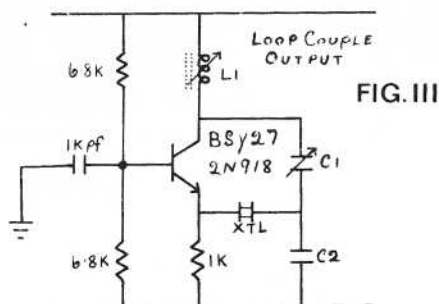


FIG. III

for 8 mc/s

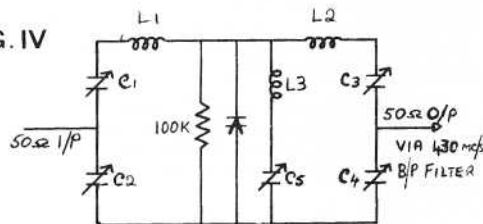
- L1 26t 26SWG $\frac{1}{4}$ inch diameter.
C1 1500 pF Fixed.
C2 150 pF Variable.

for 70 mc/s

- L1 6t 20SWG $\frac{1}{4}$ inch diameter.
C1 2-50 pF Variable.
C2 47 pF Fixed.

The output circuit resonates at 432 mc/s. and matches the device to the load. L5 C6 is a trap to reject the 144 mc/s. but is transparent to 432 mc/s. due to the large capacity. It is desirable to pass the output through a low loss 432 mc/s. filter such as a cavity as there will undoubtedly be quite large outputs at other than the desired frequency.

FIG. IV



- C1 4-40 pF
C2 4-40 pF
C3 2-20 pF
C4 2-20 pF
C5 4-40 pF

- L1 7t 18SWG $\frac{1}{4}$ inch diameter.
L2 1 in. x $\frac{1}{4}$ in. x .02 in. copper strip.
L3 2t 14SWG $\frac{1}{4}$ inch diameter.

(L2 Alternative 2t 16SWG $\frac{1}{4}$ inch, $\frac{1}{2}$ inch diameter.)

If one is completely masochistic one can attempt varactor power multiplication and details are given in Fig. 4 for a tripler from 144 to 432 mc/s. This actually works and the author has one which produces over 2 watts of 70 cms. from 3 or 4 watts of 144 mc/s. However, it is virtually impossible to attempt this work without the aforementioned spectrum analyser. The input circuit resonates at 144 mc/s. and there is a series tuned "idler" to reject 288 mc/s. and push it back into the diode and thus get more 432 mc/s out.

Fig. 5 shows a chain starting with a 60 mc/s. crystal and giving 100 mw. output at 360 mc/s. (one or two mw. is enough local osc. for a transistor mixer). Tr1. is a 60 mc/s. overtone crystal controlled oscillator colpitts style; this is followed by a grounded base tripler to 180 mc/s. (Tr2) and another grounded base stage doubling to 360 mc/s. (Tr3). Tr4 and 5 are grounded base amplifiers at 360 mc/s. producing 20 and 100 mw. in turn. All leads must be as short as possible and if care is taken then the minimum of screening will be required, that is between Tr4 and Tr5.

Fig. 6 gives the circuit of a drive unit producing 3-4 watts of 144 mc/s. from 5-6 watt of DC. Tr1 is a 36 mc/s. crystal controlled oscillator followed by a grounded base doubler to 72 mc/s. (tr2) and another to 144 mc/s (tr3). Tr4 is a straight grounded base amplifier producing some 20 mw. at 144 mc/s. This drives Tr5, a common emitter amplifier using an overlay transistor to produce about $\frac{1}{2}$ watt which drives Tr6, a similar stage, to give the final output of 3-4 watts at 144 mc/s.

TONY SPITTLE
G6 RNK/T

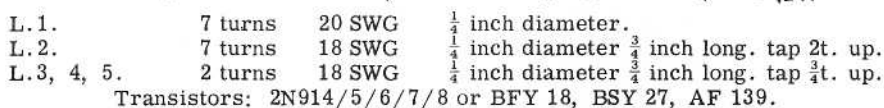
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What's all this about Convention 66? Didn't somebody tell you? - The British Amateur Television Club convention is being held October 8th at 70, Brompton Road, London, S.W.3. See you there -

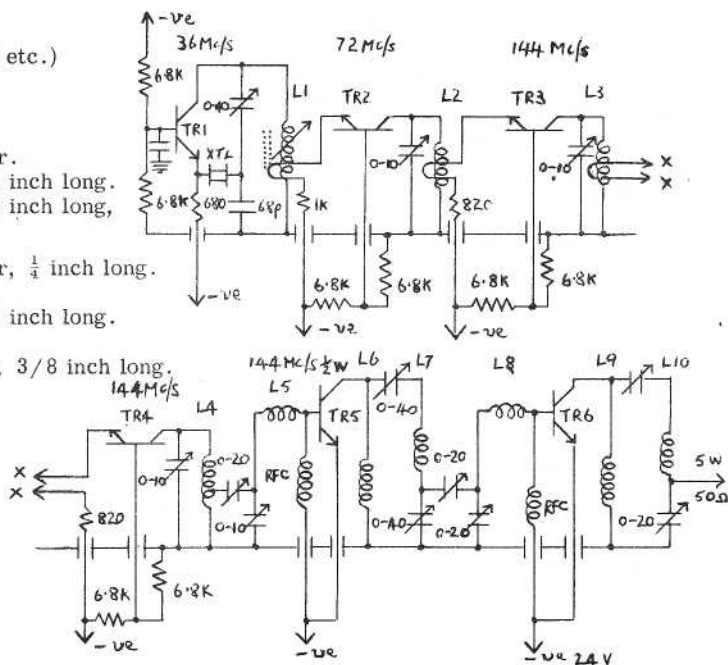
What did he say?

EXPENDITURE ON CQ-TV

The Income and Expenditure Account for the year ending 31st December, 1965, gave the cost of CQ-TV as £209. 0s. 9d. and that of printing and stationery as £41. 15s. 2d. It should read "CQ-TV £177. 3s. 9d., printing and stationery £73. 12s. 2d. The other figures remain unchanged.



XH 36 mc/s. 3rd O/T.
(Ferranti ZT 3866 £2 1½-2 WO/P.)



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A FIELD INTERLACE SYSTEM FOR CLOSED CIRCUIT TELEVISION

By A. B. E. Ellis, A.M. Brit. I.R.E.

A brief description is given of the present method of generating field interlace synchronizing pulses for television systems. A new approach is described whereby most of the disadvantages of the present method can be overcome using pulse techniques.

Introduction

The basic requirement for obtaining field interlacing synchronizing wave-forms is to make up the complete picture using an odd number of lines (e.g. 405, 525, 625). The present method makes use of a dividing chain. The picture is divided into two consecutive fields each comprising an equal number of whole lines plus half a line. This ensures that any subsequent field will always start with a separation of half a line from the start of the current field. In order to achieve this the line and field frequencies are synchronized and always contain a whole number of line periods plus a half line period. This is achieved by a frequency dividing chain from line to field frequency. The methods to be described achieve the extra half line using digital techniques.

General Description

In the normal method the line frequency is derived from a master oscillator of frequency equal to twice the required line frequency and the field frequency is obtained by counting down from this master oscillator.

Dividing circuits are not usually operated at division ratios greater than five if reliable operation is required. A chain of dividers may therefore be needed to obtain the required ratio. Thus for a 405 line 50 field/sec. interlaced picture the system shown in block form in Fig. 1 may be used. In this system the master oscillator frequency is obtained from $202\frac{1}{2}$ lines/field \times 50 fields/sec. \times 2 = 20,250 c/s.

If the field frequency is required to be synchronized to the supply frequency the output of the counter chain must be compared to the supply in a frequency or phase comparator circuit, from which an error voltage is derived and used to correct the master oscillator. This addition is shown dotted in Fig. 1.

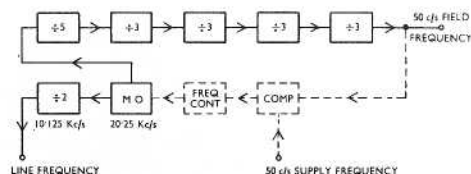


Fig. 1.

This system has obvious disadvantages arising from complexity, cost and the amount of testing and setting up required. A new approach was therefore considered starting with the basic requirement of the field interlace system, namely, that field interlace is achieved by producing successive fields differing in starting time by half a line period.

There are two methods of achieving this:

- (1) By changing the timing of the line synchronizing pulses with respect to the field synchronizing pulse by a time equivalent to a half line at every field flyback.
- (2) By changing the timing of the field synchronizing pulse by a time equivalent to half a line at every field flyback.

Method (1) would provide a simpler and more accurate interlace but it suffers from the disadvantage of requiring a sudden jump in line timing equal to half a line period, once every field period, i.e., a timing shift of \pm 50 per cent of line time with respect to one line period.

Method (2) requires a little extra circuitry but requires a timing shift of only a small fraction of the field period, i.e., a timing shift of 50 per cent of line time with respect to field time; for a 405 line system approximately 0.25 per cent of field time.

Method 1: Line Synchronizing Adjustment

In this method the field synchronizing pulses are generated by the usual methods in the camera equipment and are locked to the supply frequency if required. A field timebase pulse is used to operate a bistable circuit to produce a square waveform at half the field frequency. This waveform is used to switch between two similar waveforms which are antiphase to one another and are at line frequency. The selected waveform is shaped to produce a narrow pulse suitable for use as a synchronizing pulse for the line timebase circuits in the camera equipment. A block diagram of such a system is shown in Fig. 2, with associated waveforms in Fig. 3. It will be seen that the bistable edge occurs slightly later than a multivibrator edge. This will always be the case, due to delays in the camera field timebase circuits.

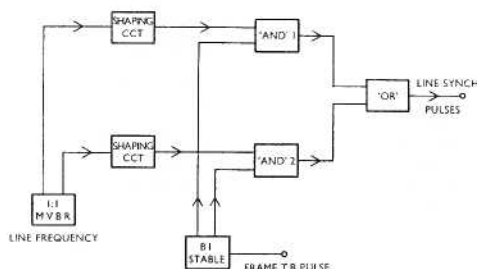


Fig. 2.

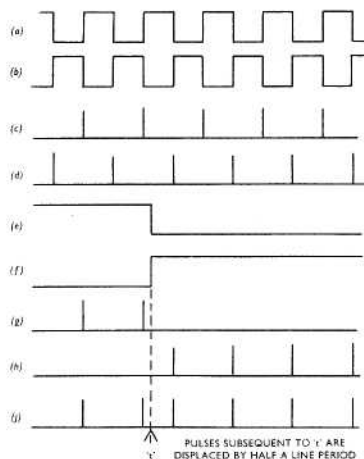


Fig. 3. Waveforms for the system of Fig. 2.

(a) Multivibrator output 1; (b) Multivibrator output 2; (c) Shaper output 1; (d) Shaper output 2; (e) Bistable output 1; (f) Bistable output 2; (g) "AND 1" gate output 1; (h) "AND 2" gate output 2; (i) "OR" gate output.

Taking any field at random, let 'And 1' be open due to its bistable input. 'And 2' will therefore be closed by the corresponding antiphase bistable input. One output of the symmetrical multivibrator is now fed via a shaper circuit and 'And 1' gate to the 'Or' gate and is used as line synchronizing pulses. When the field timebase starts its flyback a pulse from the field timebase circuits in the camera chain is used to change the condition of the bistable circuit. Thus, in the new field 'And 1' will be closed and the gate 'And 2' will be open. The antiphase waveform of the multivibrator is now fed via its shaper circuit and gate 'And 2' to the 'Or' gate to be used as line synchronizing pulses during this field. As the two multivibrator wave-forms are spaced by a half line period, the line synchronizing pulses will, on subsequent fields, also be displaced by half line period thus fulfilling the requirement that lines on subsequent fields shall be displaced by a half line period.

The degree of interlace maintained will depend upon the stability of the oscillator over a field period. If it is required to achieve interlace to a timing tolerance of ± 10 per cent of a line period then an instantaneous change of line frequency of less than ± 10 per cent is required. If a cumulative change at a uniform rate over a field period takes place, the permitted change per cycle of line frequency would be:

$$\frac{10 \times 2}{\text{No. of lines/picture}} \%$$

In the example of a 405 line picture this would require a unidirectional drift rate of less than 0.05 per cent of a line period per line period. Thus

frequency drift from thermal effects and other factors having a time constant such that the rate of change of frequency during a field period may be considered constant, is required to be kept below 0.05 per cent per line period. This is not a very stringent requirement as frequency changes as great as this are not generally sustained over a period of many lines.

The waveforms produce the ideal requirement of the half line change in line timing on each field flyback but a sudden change in relative phase of line synchronizing pulses (and hence of line frequency) of 180° causes a loss of synchronization at the start of each new field. The rate of recovery towards re-synchronization will depend upon the method used and, in the case of 'flywheel' synchronization, which has an inherently long time constant, the initial transient has not had time to settle before the next shift in timing occurs. The resulting raster will appear synchronized to either the 'in phase' or to the antiphase' synchronizing pulses but will be unable to follow both.

As most monitors employ a form of l.f. feedback or 'flywheel' synchronization further study of this method was abandoned.

Method II: Field Synchronizing Adjustment

In this method the extra half line difference between consecutive field synchronizing pulses is achieved by maintaining the line frequency constant and providing a shift of half a line period to each consecutive field flyback. The advantages of this method are that the difficulties with line synchronizing circuits experienced in the first system are obviated and the line synchronizing pulse frequency remains constant. The change in timing of half a line on the field synchronizing pulses is sufficiently small to avoid the troublesome effects referred to above. The line duration of a 405 line system is approximately 100 ns

giving a synchronizing pulse timing shift of $\pm 50 \mu\text{s}$ in $20,000 \mu\text{s}$ or ± 0.25 per cent. A block diagram of the system is shown in Fig. 4. The associated waveforms are similar to those shown in Fig. 3 in which waveform 'c' or 'd' is used for line synchronizing and waveform 'j' is further gated by a shaped pulse derived from the mains voltage to provide the pulses shown only during one part of the mains cycle. This provides the 'mains lock' if required.

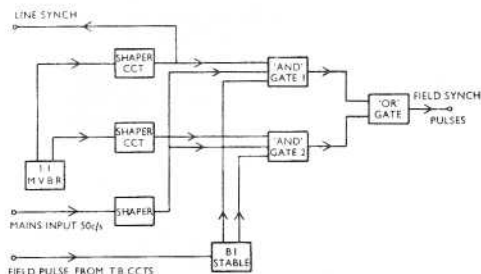


Fig. 4.

In this description the mains locking circuits will be omitted at first. The two 'And' gates have similar inputs from the multivibrator via shaper circuits. These inputs are pulses at line frequency and of short duration with respect to a line period. One however, is displaced in time to lag the other by a half cycle of the multivibrator frequency. Either one or the other 'And' gate is alternatively switched on by the bistable circuit controlled by the field timebase pulse. The output of each 'And' gate is combined to form a series of pulses suitable for use as field synchronization pulses. This combined output will comprise pulses derived from one edge of the multivibrator waveform during one field and pulses derived from the other edge for the following field. Thus, for a multivibrator having a mark-space ratio of unity, the resulting triggering pulses for the field timebase will be displaced by a half line every field. Line synchronizing pulses are obtained directly, or via a shaper, from the multivibrator.

In order to lock the field to the supply it requires only the addition of a third 'And' gate input common to gates 1 and 2. This input must occur once per mains cycle and last at least one line period but, in order to maintain a close lock with the mains cycle, should be as short as possible. This is obtained from a mains voltage via a shaper (Fig. 4). The synchronizing pulses are now inhibited except for the duration of this mains lock pulse.

The field pulse may be derived from the field timebase circuits to ensure that the bistable circuit does not change over until a synchronizing pulse has initiated the field flyback.

However, if this is not convenient, the circuit will function almost as well using the a.c. supply to operate the bistable circuit provided the field frequency is locked to the supply.

Figure 5 is a diagram of the circuit used in conjunction with a random interlace camera. Diodes V1 and V2 guide the incoming field timebase pulses to the appropriate half of the bistable circuit, VT1, VT2, VT6 and VT7 comprise the line frequency multivibrator feeding shaped pulses to be used directly as line synchronizing pulses and feeding the 'And' gates via V10 and V11. VT3 provides a suitably shaped pulse for use as a 'Mains Lock' gate. VT4 and VT5 select the appropriate outputs from the 'And' gates, amplify them and feed them via the 'Or' gate, V6 and V7 to be used as Field synchronizing pulses. Power supplies are provided by V4, V5 from a heater supply in the camera chain. The output synchronizing pulses are only roughly shaped as they are then fed to the camera chain which produces the correct synchronous shaped and combined synchronizing waveform.

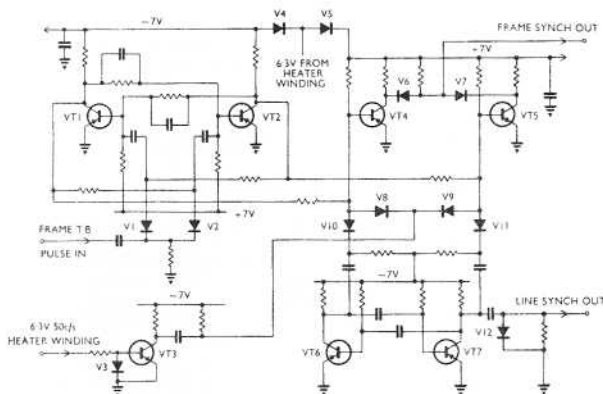


Fig. 5.

New French Television Group

A television group called "Groupement de Television Amateur - Ville de Paris" has been formed. Bertrand Deshayes is President.

A station is being built consisting of a 50 watt transmitter to work on 437.5 mc/s. video. Sound will be transmitted on 3.5 mc/s. and 144 mc/s. The standard to be used is 625 positive modulation suppressed sideband. The group - a branch of the "Radio Club Centrale de Paris" - came into being after a meeting in April between Bertrand Deshayes and amateur television enthusiasts. Bertrand, who has written to us, would like to exchange ideas and technical know-how with B.A.T.C.

peter johnson

TRANSISTOR TUNER FOR 430/440 Mc/s

Introduction

This tuner was designed for the reception of Amateur Television signals in the 70 CM band. It tunes from 430 Mc/s. to 440 Mc/s. and has an intermediate frequency output which may readily be adjusted to one of the Broadcast channels in Band 1, 40-65 Mc/s approx. channel 1 Band 1 being chosen for example. In order to prevent I.F. breakthrough the channel should not be the same as the local Band 1 Broadcasting Transmitter. The tuner has two RF stages followed by a crystal mixer. The I.F. output from the mixer is passed to a single stage amplifier and then to the domestic receiver provided it has a Band 1 channel selector. The local oscillator of the tuner may be made to work above or below the signal frequency, i.e., 380 Mc/s or 480 Mc/s. ± 5 Mc/s. for tuning.

Circuit Description (See Fig. 1)

1st RF Amplifier: This works in the grounded base mode the RF signal input being applied to the emitter. The input impedance at the emitter of the transistor TR1 is approximately 75 ohms and so the aerial feeder is nearly matched without the need for a tuned circuit. This does mean that the RF stage has greater stability. The base of TR1 is earthed to RF by the 1000 PF disc ceramic capacitor. Remember to keep the leads of this and other decoupling capacitors as short as possible without causing damage to the components. When soldering use a heat shunt made from a crocodile clip. The DC conditions are set by the emitter and base resistors. A suitable choke of say 5 turns 24 SWG Enam Copper Wire close wound on a $\frac{1}{8}$ " dia. may be fitted at the input socket to earth (chassis) to provide Voltage Protection at the input capacitor. The Collector Tuned Circuit is a quarter wave line of 16 SWG Tinned Copper Wire tuned by C1, a low impedance tap at the end of line is capacity coupled to the emitter of TR2 and provides a low impedance match.

2nd RF Amplifier: This is identical to the first stage except the collector tuned line is slightly shorter due to the added capacity of the Mixer diode and the local oscillator connection.

The Local Oscillator: The transistor used for the local oscillator is required to have sufficient current gain at 390 Mc/s. in order to oscillate and whilst many transistors may be used, care should

be taken in choice of Max. Frequency gain, as it is possible that the transistor will oscillate at two or more frequencies, if Ft is too high, i.e., (GM290A, 1000 Mc/s). Again care should be taken to keep lengths of the connections to e, b, c, as short as possible. Disc ceramics are a must except where supply leads enter the various compartments when feed-through capacitors should be used. This is especially important in the RF stages and IF amplifier IF Max. stability and high gain are to be obtained.

Mixer: A VHF diode of any type will usually do. Possible types: IN21; IN23; GEX66, etc. In order that the mixer diode should work efficiently, it is essential that the local oscillator provides the correct diode current to flow, approx. 100-500 A. This may be adjusted by varying the voltage to the oscillator transistor 4.5V to 9V. The present convertor oscillator runs at 9V and provides 250 A Crystal Current. The I.F. Amplifier following the diode mixer will see as its signal source the difference frequency between oscillator and the incoming signal, and is arranged to be one of the Channels in Band 1.

I.F. Amplifier: This should provide some 15 db gain with tuned input and output circuits without oscillation. To obtain this gain it is quite essential that the input and output circuits are fully screened, with staggered tuning to provide the 3.5 Mc/s. Bandwidth. No difficulty should be experienced with the stability of this amplifier, if the Passband is 6 Mc/s. less gain is available approx. 12-14 db only. If a Passband of 1 mc/s. is desired the stage gain may cause oscillation. Cure - reduce gain by dropping the volts on TR4/ or neutralise with small capacitor.

Construction

The tuner is built on 22 SWG sheet copper which may be cut out with a good pair of scissors and folded by hand with blocks of wood and a soft rubber or felt hammer. Soldered seams and soldering of feed-through capacitors, compartments etc., may be done by placing parts together with paper clips and placing on top of electric stove hot plate until solder runs along seams around feed-throughs and around compartment edges. Thus all are fixed together and allowed to cool, otherwise a superspeed iron is needed.

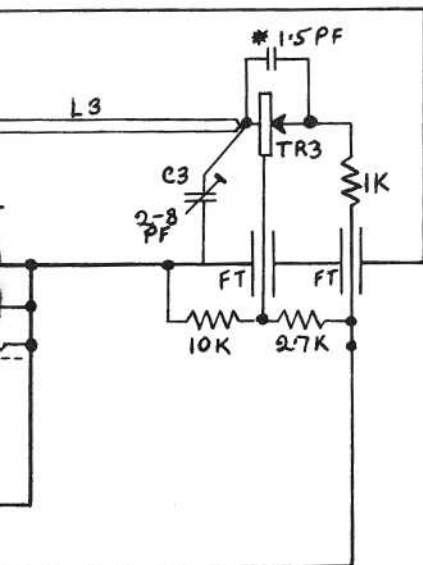


Fig.1

*Capacitor is arranged by not earthing the metal case of the transistor.

FTs. 1000 pF

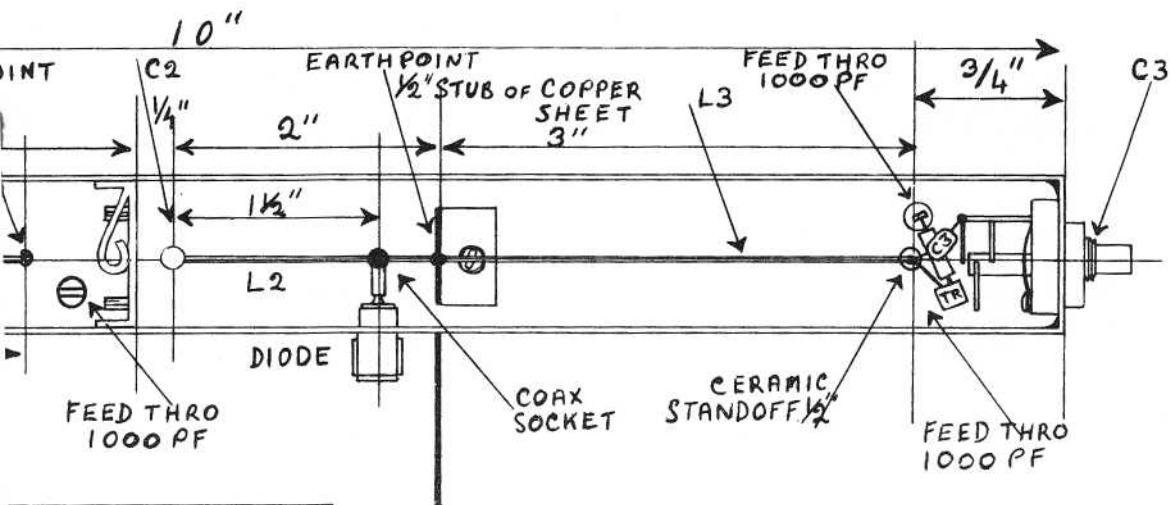
C1, C2 Low Inductance Cs ceramic tube.

C3 Airspaced Variable.

8pF Fixed in Series with 8pF Variable.

C4 3-30 pF Philips.

C5 3-30 pF Philips



The dimensions of parts of chassis are shown in Fig. 2 & 3. The layout of the RF stages is shown in Fig. 4. The last components to be fitted after a circuit check should be the transistors, care being taken in not overheating connections. A heat shunt should be used.

Operational Notes

If co channel VHF stations tend to cause troubles when tuning, it may be necessary to tune the input of TR1 as shown in CQ-TV 57 and repeated here, Fig. 5.

If a Passband of 10 Mc/s is required of the RF stages without re-tuning for Max. gain, 18V supply should be used on TR1 & TR2. Do not exceed 18V with any transistors used - stagger tune RF1 and RF2 for stability, or shunt the two tuned lines with $1\text{ K}\frac{1}{2}$ resistors approx. $\frac{1}{4}$ " from the tuning capacitors C1 and C2. The prototype works with 18V to RF stages and 9V oscillator, 12 Volts to I.F. Amplifier, but it has also been working with one 9V supply to all stages and still performs very well. At 9V total is 15 ma. approx.

The convertor is extremely stable and has a great deal more gain than a commercial valve VHF tuner. Local oscillator drift is less than 500 C/S over 2 hours - main cause of drift is temperature change.

For optimum performance the component values for RF1 & RF2, i.e., TR1, TR2, should be calculated from the requirements of the type of transistor used in these two positions, but the values given will give a more than satisfactory result with many different types, but take care.

Performance

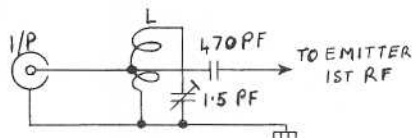
Possible overall gain 25-30 dbs RF
 Conversion gain 12 dbs.
 Current Consumption at 9V all stages approx.
 15 m.a. \pm 2 m.a.
 Current Consumption at 18V on RF1 & RF2 only
 9 m.a. \pm 3 m.a.
 Stability Good
 Construction Rigid.

Transistors for RF1, RF2 2N2363, AF186.
 Transistors for Mixer I.F. Amp. OC170, OC171, AF114.

Transistors for Local Osc. AF186, GM290, GM290A (AFZ12.380 mc/s.).

Note: A Bottom cover is required for all compartments and may be made of one piece. (see Fig. 7).

C3 may be a 2-5 PF tube trainer in position of standoff tag at end of L3 line.



$L = 1.5\text{ T TAP } \frac{1}{2}\text{ T FROM } \pi\pi$

Fig.V

SL SHORTING LINK

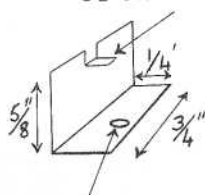


Fig.VI

HOLE FOR FIXING
IN FINAL POSITION

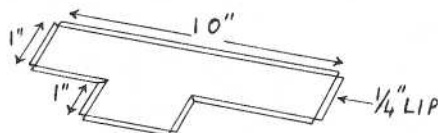


Fig.VII

THE UNIJUNCTION TRANSISTOR IN COUNTERS OR FREQUENCY DIVIDERS

The tunnel diode is probably now well known for its negative resistance characteristic, which is voltage stable. The unijunction transistor (UJT) also has a negative resistance region in its characteristic but it is current stable, see Fig. 1. The resistance in the region A to B is about that of a reverse biased silicon diode. From the peak point B to the valley point C is the negative resistance region. After C the characteristic closely resembles that of a forward biased silicon diode. The peak point voltage is related to the interbase potential as follows:-

$$V_p = V_{BB} + V_D$$

Where V_D is the forward voltage drop of a silicon diode and V_{BB} is the intrinsic standoff ratio which is constant. But V_D has a negative temperature co-efficient. Fortunately the resistivity of silicon has a positive co-efficient and so with suitable choice of circuit values the two can be made to cancel to some extent. For a complete descrip-

tion of the operation of the UJT see reference 1.

The simplest circuit using a UJT is shown in Fig. 2. The capacitor C charges up through the resistor R towards +E, but when the voltage reaches V_p the UJT fires and discharges C to a low value. Charging then recommences.

Thus an exponential sawtooth waveform is produced at the UJT emitter. This oscillation can be synchronised either by injecting positive pulses in series with C or by modulating +E with negative pulses. A divide-by-405 circuit using these techniques can be made with three UJT's, three capacitors and seven resistors; see reference 2.

However, for those who distrust synchronised oscillators, a step counter can be made; see reference 3. The basic circuit shown in Fig. 3 consists of a standard diode pump circuit whose output is discharged by the UJT. The UJT fires on the "risers" of the exponential staircase waveform. The circuit in its simplest form will not cascade with other similar circuits nor can the division ratio be adjusted. For these reasons the circuit of Fig. 4 was devised.

VT1 provides the drive for the diode pump. By connecting D2 to the junction of VT2 emitter and VT3 base 1 the staircase is referred to that point. So by varying the interbase potential of VT3, via VT2 and RV1, the firing point can be varied and hence the division ratio. A decoupled potentiometer could be made to replace VT2 and RV1 but at the cost of higher power consumption.

A 405 divider was made by cascading three such circuits, the capacitor values of which are shown in the table below:-

As the diode pump is a true counter it can also be used to count out the eight half-line frame pulses: this has successfully been tried.

References:

1. "The How and Why of Unijunction Transistors" by Texas Instruments.
2. "British Semiconductor Survey, 1963" by C. M. Sinclair.
3. Wireless World, March 1964, page 110.

R. P. HUBBARD

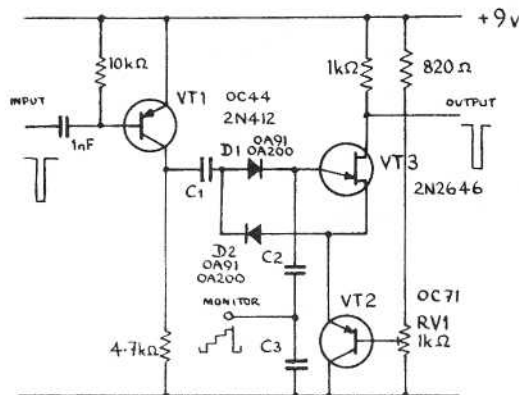


Fig. IV

20250 c/s to	2250 c/s (+9)	C1 = 330 pF	C2 = 5 nF	C3 = 100 nF
2250 c/s to	250 c/s (+9)	1500 pF	22 nF	500 nF
250 c/s to	50 c/s (-9)	22 nF	150 nF	2 uF

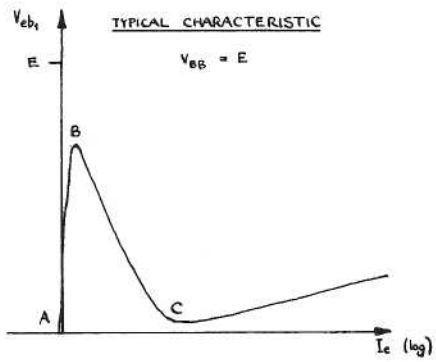


Fig. I

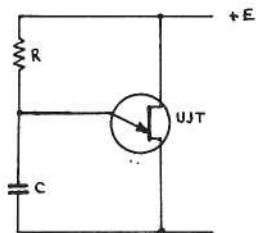
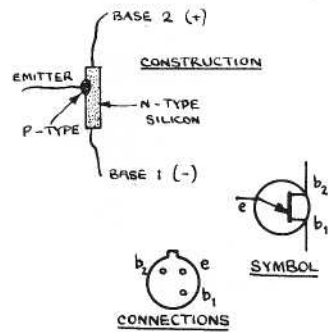


Fig. II

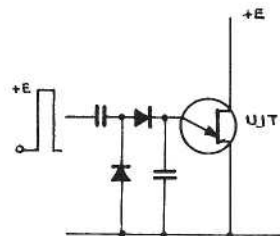


Fig III

SEPARATE MESH VIDICON

In a normal vidicon tube the mesh at the target end of the wall anode is mechanically and electrically fixed to the wall anode and consequently the electrostatic field existing between the mesh and the target will vary with beam focus. This is because beam focus is achieved by the combination of the magnetic and electrostatic fields and the adjustment of beam focus is usually achieved by changing wall anode volts.

The separate mesh vidicon, as the name implies, does not have its mesh electrically connected to the wall anode but brought out to pin 3 at the base of the tube. The separate mesh vidicon has its other connections identical to a normal vidicon.

Separate Mesh Vidicon

Pin No.	Connections
1	Heater
2	Modulator G1
3	Mesh G4
4	Do not use
5	Limiter G2
6	Wall anode G3
7	Cathode
8	Heater
Flange	Signal Electrode
Short Pin	Do not use

The Connections for a normal vidicon are as above but do not use Pin 3.

The advantages of a separate mesh vidicon are several:-

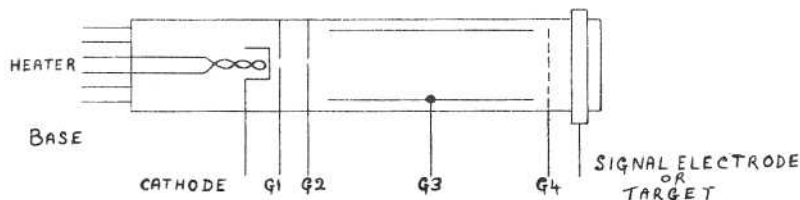
1. Resolution

For optimum resolution and beam landing for a given wall anode voltage, the mesh should be kept at approximately 1.5 times the wall anode voltage. Under these conditions the high frequency response is almost double that of an ordinary vidicon while the scanning currents have only to be increased by about 20%. A worthwhile improvement results from using the mesh just a few volts positive with respect to the wall anode without any significant increase in scanning requirements.

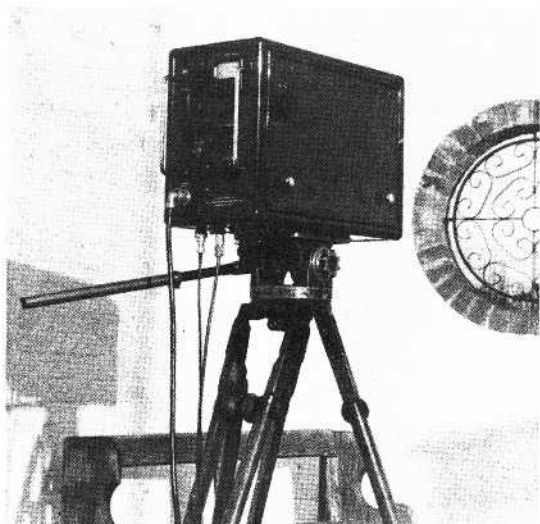
To use a separate mesh vidicon in a camera designed for normal vidicons the mesh should be joined to the limiter (pin 3 to pin 5) providing the limiter is positive with respect to the wall anode. If the mesh is run at a lower voltage than the wall anode an ion spot may be created.

2. Beam

The setting of the beam current in the separate mesh vidicon is less critical than in the normal vidicon. It is possible to run the tube with more beam than is actually required, so taking account of highlights without defocussing taking place. This is because the electrostatic field between the mesh and the target in this type of tube is strong so preventing the beam diverging and also improving the geometry. There is much less rotation of the picture as beam focus is varied when the mesh is 20 volts or more positive with respect to the wall anode compared with a normal vidicon.



VIDICON camera



On the pulse side circuitry is of the least complexity, the line running on a random scan basis and line syncs. being derived from the square pulses generated at the start of the scan waveform at the output stage. One double triode suffices for frame, one half being used as a sawtooth amplifier and output, the other half functioning as a blocking oscillator, thereby providing both a sawtooth scan waveform and a usable blanking pulse at the grid after passing through an unbiased inverter to suppress the negative projection of the integrated waveform. Frame syncs. are derived from the blanking pulse which passes through a gate to be mixed with the line syncs. in a single stage to provide comp. syncs. for the monitor.

The video amplifier is of the R-C coupled type with shunt peaking and more or less follows conventional circuit techniques.

In spite of the absence of porches positional distortion is low; also there is no line suppression period after frame sync., but in spite of these omissions the camera gives very satisfactory pictures in the circumstances and will define the 2.5 mc/s. bar of test card D when the line oscillator is running at approximately 10.125 Kc/s. (i.e., 405 lines).

by R. Field

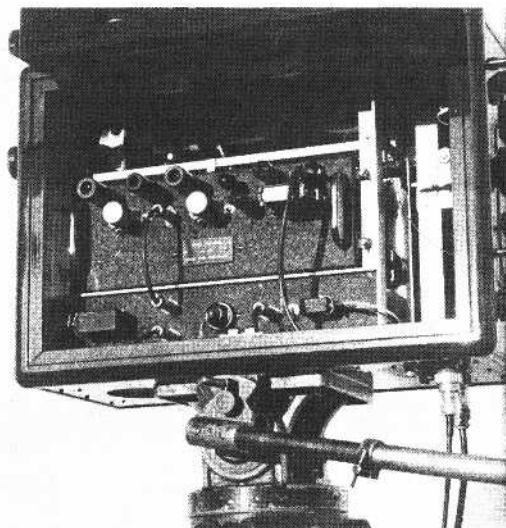
The following is a brief description of a vidicon camera I have built and hope to have on show at the Convention, to demonstrate the simplicity of the circuitry.

The camera is completely self contained apart from a stabilised power unit.

The case is made out of "Imlock" extrusion and aluminium panels and is painted mid coach green. The "Imlock" extrusion was recommended to me by a fellow member, and I sincerely advise any other member considering building an IO or vidicon camera to use it since it is such excellent material for this purpose.

The tube carriage racks for optical focus in nylon which in turn runs close fit inside aluminium channel and is operated by a small epicyclic gear. The nylon, owing to its self lubricating properties, provides smooth action for focusing.

Below the tube assembly are two chassis, one of which generates all necessary pulses and the other providing video amplification; both chassis being easily removed by four wing nuts and three inter-connecting plugs.



POST BAG

M. Lageveen, PAØMZJ has a 625 line vidicon camera using random interlace and with a response better than 5 mc/s., and he is building a vision modulator and a tripler/final amplifier using QQV06/40's for 50 cms.

*** **

John Thompson, G3NWU, is now also licenced as G6ACI/T and has worked G6ABI/T over a distance of 30 miles. John is active each evening on 2 metres and 70 centimetres and is looking for skeds. The transmitter uses a QQV0-640A with input power up to 50 watts peak.

*** **

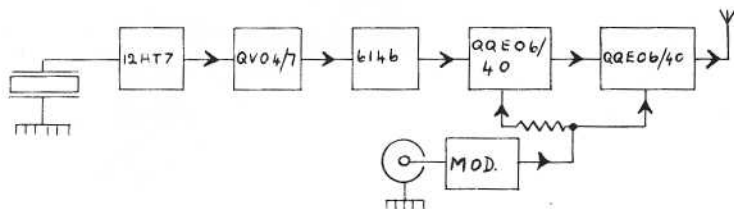
Doug Ingham, ZL2TAR, sends us some notes from New Zealand on activity there. Doug and ZL3LX are working on picture monitors having stabilised scans and E.H.T. back porch clamp and DC to 10 mc/s. response. (The best of Luck.)

ZL3LX should be on the air by the end of this year. Plans are being made for the exchange of vision and sound with ZL2APC and Steve, ZL2-ASF.

*** **

Steve Fogerty, ZL2ASF, has dropped us a line to say he is completing: (a) Sync. Generator; (b) transmitter; (c) Checker-board pattern generator. Steve also says that Doug Ingham now has working a sync. pulse generator, a pattern generator, a 70 cm transmitter and a vidicon camera. Doug's Q.T.H. is 510 ft. above sea level and he is using an 8 over 8 slot aerial on a 25 foot tower. Steve is going to use a 25 foot diameter parabolic dish on a 40 foot tower, and says that there is little wind to worry about.

The transmitter uses screen modulation and has this line-up:-



D. R. Back has a vidicon camera which uses non-interlaced scans but with provision for synchronising to a feed of pulses from a pulse generator. The monitor is a modified Perdio Panarama. Towards the end of the year R.A.E. permitting D. R. Back should have a low power transmitter working.

*** **

F8UM has a 9 valve vidicon camera working using the scan coils from CQ-TV33. Ron Whiting, G3POF is working on CCTV before attempting to radiate vision. The picture source will probably be a flying spot scanner, using a 931A photo multiplier. Ron has one or two spare 931A's if anyone is stuck. He would like to hear of any local T's. Ron's address is, Bretton, Munday Dean, Marlow, Bucks - Tel. Marlow 4077.

*** **

Tony Reynolds (G6SAU/T) is now active on 70 cm. 433.1 mc/s. using a transmitter consisting of a DET24 driver into a 4 x 150 P.A. Output is about 50 watts. Tony, who is at Paignton, has made contacts with Dave Jones (G6LYF/T), G3EGU at Weymouth, GSZT Plymouth and G8ADP Teignmouth. He would like to hear from other members in the south-west. His next project is to convert a small caravan into an outside broadcast unit with a 3 Kw generator for power.

*** **

W. G. Taylor is now licenced G6ACF/T. The transmitter is not quite completed. It will work into an 8 over 8 aerial. The next project is a flying spot scanner.

*** **

POST BAG

T. Fabris of Lille, France, would like to contact British amateurs on 70 cms. between 9.30 p.m. and 10 p.m. - the times allowed to French amateurs. He is waiting for his licence. He will operate on 437.5 mc/s. 625 lines. T. Fabris has been receiving British radio amateurs S8-S9 but receives no answers to his calls. He would like to arrange contacts. His address is Fabris - Tranquille, Sailly-Saillises, Somme-80, France.

*** **

Roger Naphorn writes to say he has just taken the R.A.E. and if he passes hopes to take out a /T licence. Roger's thoughts on television gear are on a flying spot scanner and a low power transmitter.

*** **

Joseph Walton is building a transistorised vidicon camera using printed circuit boards supplied by F.S.T. Electronic Consultants Ltd., and would like to hear from any other members who have tried this circuit. Joseph's address is: 27, Hawthorn Road, Ribbleson, Preston, Lancs.

*** **

Errata on CQ-TV 58

The video output from the transistorized distribution amplifier should be taken from the collector and not as shown in CQ-TV 58.

In the instructions on U.H.F. tuners the text should read, "Unscrew trimmer 3 (not 4) and adjust I.F. card together for max. noise on the receiver".

For Sale: Richard Volck, G6RKY/T, has for sale the following. All those interested should contact him at 125, Mercers Road, Tufnell Park, London, N.19.

- 1 Grundig TV camera, 1" vidicon, with separate p.s.u. Switchable 405/625. Reverse line and frame scan. Output 1v. video to 75 ohms. All B9A valves. £65.
- 1 Staticon camera tube. About 120 hours use. £5.
- 1 70 cm. AF139 pre-amp. 30/-.
- 1 TW 70 cm. converter with p.s.u. £12.
- 3 410-0-410v. transformers with usual L.T. windings. 10/- each.
- 1 Home-brew low-powered 2m. exciter. About 1w. output. Will drive a QQVO2-6 tripler to 70 cm. Also includes single-ended EL84 choke modulator. £4.
- 6 8 mfd. 350v. AC working paper block capacitors. 7/6d. each.
- 1 each VCR139A and VCR97 C.R.T's. 10/- each.

Tape Lectures.

Some recorded lectures are available on loan from Grant Dixon. The titles include:-

Flying Spot Scanning
Getting Started in Amateur Television
Slow Scan Television
Amateur Colour Television
70 cm.Reception.

Technical Queries.

These should be as precise as possible and will be answered by volunteers in their spare time. B.A.T.C. cannot supply full circuits and comprehensive data other than those which appear in CQ-TV. Queries should be sent to the Hon. Secretary.

Components.

Members requiring special components are invited to register their needs with the Hon. Secretary. Help will be given whenever possible, but this does not cover items which may be purchased in the normal way.

Membership.

Membership costs 10s. (\$2) per annum, payable on the 1st January. New members are asked to enclose 1s. per month remaining of the current year plus 10s. for the following year.

Details are available from the Hon. Secretary of B.A.T.C.

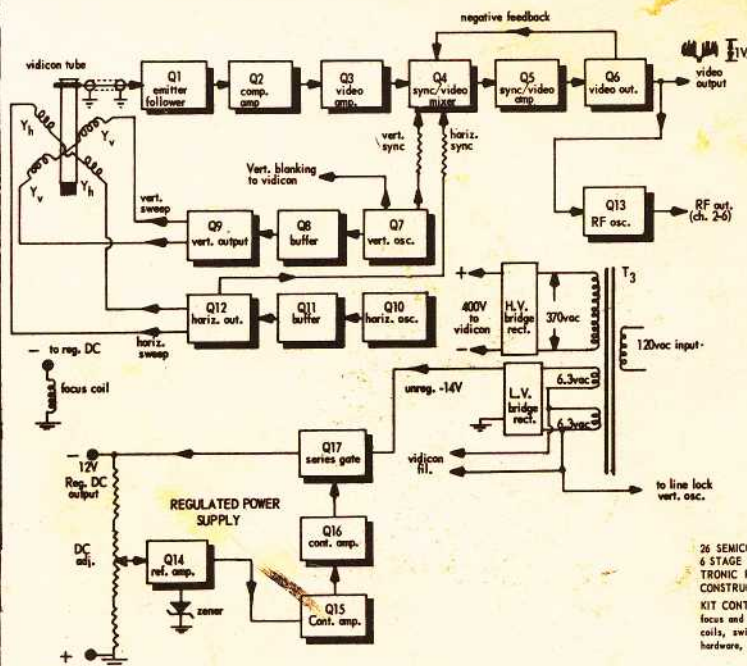
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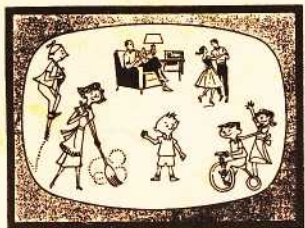
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